

FINAL PROGRESS REPORT
to
CA Department of Pesticide Regulation

March 31, 1998

Principal Investigators:

Dr. Robert M. Timm, Superintendent & Ext. Wildlife Specialist, UC Hopland Res. & Ext. Center

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Project Title:

Controlling Coyote Predation on Sheep in California: A Model Strategy

Summary:

We are field-testing an innovative strategy of selectively removing known livestock-killing coyotes, in combination with deployment of llamas as guard animals, in an effort to significantly reduce predator-caused losses among our research sheep flock. Results for Calendar Year 1997 and results to date in early 1998 suggest our efforts have been responsible for substantially reducing the number of lambs and adult sheep lost to coyotes on the Hopland Research & Extension Center, as compared to previous years.

Primary use of Livestock Protection Collars (containing a registered toxicant), and secondary use of radio-telemetry, has allowed selective removal of *only* livestock-killing coyotes. Collar use involves considerable time and effort in livestock management and record-keeping activities, due to registration requirements and to public sensitivities toward pesticide uses and predator control. Additionally, indications are present that guard llamas may be of some value in protecting young lambs in pastures from coyote attack. Data over two additional lambing seasons is likely to be needed to confirm that the reduction in coyote damage observed to date is a result of the presence of guard llamas.

The Predator Research Advisory Group (innovator group) established at this project's inception has remained active and involved at several levels. Discussions within this group led to submission of a complementary project proposal designed to field test a new coyote bait delivery device, which is now funded by UC. Operational use of LP Collars by USDA-WS personnel on cooperators' ranches in the North Coast area, begun in early 1997, continues with a high degree of success. Information provided by our research is helping local regulatory officials answer questions posed by anti-pesticide and anti-predator control groups in the North Coast area. Information developed at Hopland is also being conveyed to local and regional wool growers' organizations and with individual ranchers via Cooperative Extension advisors, with state USDA-WS staff, and is being shared with other researchers in the western and central U.S.

Results and Discussion:

Objective 1

Ongoing efforts to capture coyotes on Center property have been quite successful during the past year. A total of 14 new coyotes were captured and radio-collared, while 8 collar-equipped coyotes were also recaptured. Currently, 19 coyotes are equipped with radio-collars, of which 11 individuals regularly spend time on HREC's property. Two additional radio-collared coyotes regularly spend time on properties adjacent to HREC.

Livestock Protection Collar Use

Four deployments of Livestock Protection Collars occurred between April 1, 1997 and the present. Of these, coyotes attacked collared sheep and punctured LP Collars in two cases. In the third case, a coyote attacked a collared sheep and killed it without puncturing the LP Collar. (We believe that this coyote was the same coyote that subsequently attacked a collared sheep and punctured the collar in an adjacent pasture). The fourth case was an attempt at preventive control, but no coyote attacks on collared sheep occurred during the deployment.

Our data base regarding use of LP Collars continues to grow. Since initial use of LP Collars at HREC began in October 1995, we have made 17 deployments, of which 6 have been successful in eliciting an attack and collar puncture. None of our attempts to use the collar as a preventive tool (i.e. to "clear out" killer coyotes from an area where there has been a history of predation, but where recent coyote attacks have not occurred) has been successful. Carcasses of 4 coyotes killed by LP Collars have been retrieved from the field. Of these, 3 were radio-collared animals (1 breeding male, 1 transient male, and 1 breeding female).

MALE → We remain quite encouraged that our strategy of preventing and controlling coyote predation on our sheep flock, primarily by removing *only* known killers, is demonstrating success. The loss rate of lambs during 1977 (4.5% of available lambs) was the lowest level in this decade (vs. 7.1% to 19.1%, see Tables 1 & 2 and Figure 1), and the number of confirmed coyote-killed plus "missing" sheep for 1997 was the lowest total since the mid-1970s at the Center. To date in the current lambing season, confirmed lamb losses to coyotes remain low and similar to losses during 1997. This lends further credence to the working hypothesis that only a few individual coyotes of the resident population at HREC are responsible for the great majority of sheep losses, and if selectively removed, losses can be significantly reduced. Related to this hypothesis is the idea that resident, territorial coyotes which do not presently kill sheep are an advantage and should not be removed, because they will likely exclude other (potentially troublesome) coyotes from becoming resident. The Livestock Protection Collar is the only known tool which can selectively remove *only* sheep-killing coyotes. In 1996-97 we removed, via radiotelemetry and firearms, 3 other coyotes thought to be sheep killers. However, we have not used this strategy recently. Such a strategy is, of course, impractical when applied to commercial sheep production situations.

Mr. Guy Connolly, recently retired research wildlife biologist with the USDA National Wildlife Research Center and who was primarily responsible for EPA registration of the LP Collar, traveled to Hopland on Feb. 10, 1998 to serve as a consultant on this project. He was encouraged with our progress to date, and he offered a number of excellent suggestions for our continuing field work.

Guard Llama Use

20 → The relatively low incidence of sheep-killing by coyotes at HREC, which has been the norm since late 1996, makes study of llamas as potential guard animals more difficult. During the 1997 lambing season, no confirmed coyote-killed sheep were found in pastures containing llamas, while 6 kills occurred in comparable pastures without llamas present.

Three yearling ewes were killed by coyotes in Middle Pasture after April 1, 1997, in the absence of a llama. However, a yearling ewe killed by a coyote in Huntley Pasture on September 7 was in the presence of a llama, while an earlier coyote kill (Aug. 9) in this pasture occurred with no llama present. Two additional sheep carcasses were found in this pasture, but because of their condition at the time they were located, it was impossible to determine whether coyotes were responsible for these losses. Five additional sheep became "missing" during this period. If these sheep were also killed by a coyote, the kills occurred during the time when a llama was present. Additionally, no coyote kills occurred in pastures where two other llamas were present among adult ewes in summer and early fall 1997. It should be noted, however, that adult ewes are generally less vulnerable to coyote attack than are yearlings.

To date in 1998, one confirmed coyote kill has taken place in a pasture containing a guard llama. In two similar pastures not containing llamas, a total of 4 coyote kills have been found. Close observation of coyote predation on lambs in these paired pastures will continue for the remainder of the spring period when lambs are present (until May).

Our subjective interpretation of llama effectiveness as guard animals is as follows: We believe certain individual llamas have a strong tendency to behave aggressively toward canids. This is borne out by repeated problems our herders encountered in attempting to move, handle or otherwise manage sheep with the aid of their herding dogs when llamas are present. This is a significant impediment to use of guard llamas and we believe has resulted in herding dog injury as well as behavioral problems. Llama presence, in our experience, makes sheep movement and management considerably more difficult. While our data to date indicate that guard llamas may deter coyote predation on lambs, the low number of total confirmed coyote kills makes it impossible for us to reach a conclusive evaluation. Another one or two years' data will assist in clarifying the question of llama effectiveness. It is also likely that an individual llama's effectiveness as a guard animal may depend on the degree to which it is bonded to a group of sheep, its ability to see the entire pasture and the sheep present within it, and its individual demeanor. We are in contact with researchers at Utah State University who have been exploring these and related aspects of llama success or failure as guard animals.

Objective 2

Our "Predator Research Advisory Committee" / innovator group met on May 5 and on October 21, 1997 (meeting agendas attached). The next meeting of this group is now scheduled to occur in May 1998. The group continues to maintain a high level of interest in predator research, as well as in the developing strategies for use of the LP Collar by USDA-Wildlife Services personnel.

Discussions initiated during the Committee's meetings in early 1997 led to the formulation and submission of a proposal to study the "Coyote Lure Operative Device (CLOD)" at Hopland. This proposal was awarded a one-time grant of \$29,660 from the UC Division of Agriculture & Natural

Resources. The device has the potential for selectively delivering chemosterilants, vaccines, or toxicants to coyotes or other canids. The newly-funded research complements the current DPR-funded project. A graduate student from Utah State University has been recruited to undertake the field research related to this project. He arrived at Hopland in January 1998, and is finalizing plans to initiate the first field trials of the CLOD within the next several months.

The Committee is being expanded in its diversity and scope by including invitations to additional participants (e.g. representatives of the Dept. of Fish & Game, and the County Agricultural Commissioner). At future meetings, UC researchers presently involved in mountain lion ecology, management, and genetics studies will be discussing with the Committee their objectives and techniques, some of which closely parallel research needs in the field of coyote damage management. An additional topic of future discussions will likely be the initiative measure that likely will appear on the November ballot in California which, if passed, would ban the use of Compound 1080 and the use of leghold traps for most uses (including research uses) in this state.

Objective 3

Information developed to date via this project has been shared, in part, via popularized articles published in the monthly Mendocino County Farm Bureau News. A report on LP Collar use in California was presented by Dr. Timm at the 13th Great Plains Wildlife Damage Control Workshop in April 1997, and a related report was presented by Karen Blejwas at the 4th Annual Conference of The Wildlife Society in September 1997 (*see attached*). User groups remain very interested in the HREC results to date and look forward to the coming lambing season's data. Dr. Timm presented findings to date to a statewide conference of USDA-APHIS-WS staff and administrators in Quincy, Calif. during the week of September 8. Contact with local and regional wool growers associations will continue to be maintained through assistance of UC Cooperative Extension advisors in the north coast area.

Additionally, Dr. Timm and other HREC staff have participated as resource professionals in ongoing meetings held by a group in Marin County. Organized in July 1997 by Agricultural Commissioner Stacy Carlsen, this "Community Coalition on Livestock Predation" has been debating the possibility of alternative methods for controlling coyote predation on livestock. The group is a mixture of livestock producers, conservationists, and animal welfare proponents.

Recent Publications and Presentations on Predator Research

UC Hopland Res. & Ext. Center

- Blejwas, K., M. M. Jaeger, and D. R. McCullough. 1997. Turnover, territories, and sheep depredation in an exploited coyote population. (Abstract). Presented at 33rd Annual Meeting, Western Section of The Wildlife Society, Feb. 5-8, San Diego, CA.
- Blejwas, K., M. M. Jaeger, and D. R. McCullough. 1998. Reducing coyote predation on livestock through selective control. (Abstract). 4th Ann. Conf. of The Wildlife Society, Sept. 21-27, 1997, Snowmass Village, CO.
- Conner M. M., M. M. Jaeger, and T. J. Weller. 19___. Identifying coyotes that kill sheep on a northern California ranch. Submitted to *Journal of Wildlife Management*.
- Conner M. M., M. M. Jaeger, and T. J. Weller. 19___. Impact of coyote removal on sheep predation on in California. Submitted to *Journal of Wildlife Management*.
- Neale, J. C. C. 19___. Evaluating bobcat predation on lambs in North Coastal California. Submitted to *Journal of Wildlife Management*.
- Neale, J. C. C., B. N. Sacks, M. M. Jaeger, and D. R. McCullough. 1997. Overlap and partitioning of space and resources by bobcats and coyotes in northern California. (Abstract). Presented at 33rd Annual Meeting, Western Section of The Wildlife Society, Feb. 5-8, San Diego, CA.
- Sacks, B. N. 19___. Ecology and behavior of coyotes in relation to depredation and control on a California sheep ranch. Submitted to *Wildlife Monographs*.
- Sacks, B. N. 19___. Increasing prevalence of canine heartworm *Dirufilaria immitis* in coyotes of California. Submitted to *Journal of Wildlife Disease*.
- Sacks, B. N., J. C. C. Neale, M. Jaeger, and D. R. McCullough. 1997. Ecology of coyotes in relation to depredation and control on a California sheep ranch. (Poster presentation). Presented at 33rd Annual Meeting, Western Section of The Wildlife Society, Feb. 5-8, San Diego, CA.
- Timm, R.M., G.D. Simmons, and J.R. Hays. 1997. Livestock protection collar use in California. Proc. Gt. Plains Wildl. Damage Control Wkshp. 13:24-32.

Table 1.**Sheep Killed by Coyotes (Confirmed) at HREC**

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
<i>January</i>	7	26	13	14	1	4	12	2	5	13	8	1	2
<i>February</i>	16	19	10	14	2	3	3	10	19	13	18	5	6
<i>March</i>	16	17	4	16	7	8	4	15	25	16	16	5	2
<i>April</i>	7	1	0	7	5	2	0	6	25	11	13	0	
<i>May</i>	1	5	3	1	5	2	0	5	15	12	2	0	
<i>June</i>	3	0	1	1	5	5	0	3	14	4	0	0	
<i>July</i>	0	2	1	1	11	7	0	1	22	0	9	2	
<i>August</i>	0	6	12	7	3	0	6	2	7	4	2	2	
<i>September</i>	1	27	0	5	21	11	5	0	6	3	6	1	
<i>October</i>	13	10	0	1	7	9	0	0	1	5	3	1	
<i>November</i>	1	5	2	2	1	3	2	0	9	2	1	2	
<i>December</i>	2	4	9	3	1	7	0	2	2	0	0	0	
Sum, Year	67	122	55	72	69	61	32	46	150	83	78	19	
Sum, Season*		85	85	77	44	68	56	54	108	116	71	32	
Sum, Nov-Mar		65	36	55	15	17	29	29	51	53	44	12	12

*July 1 through June 30

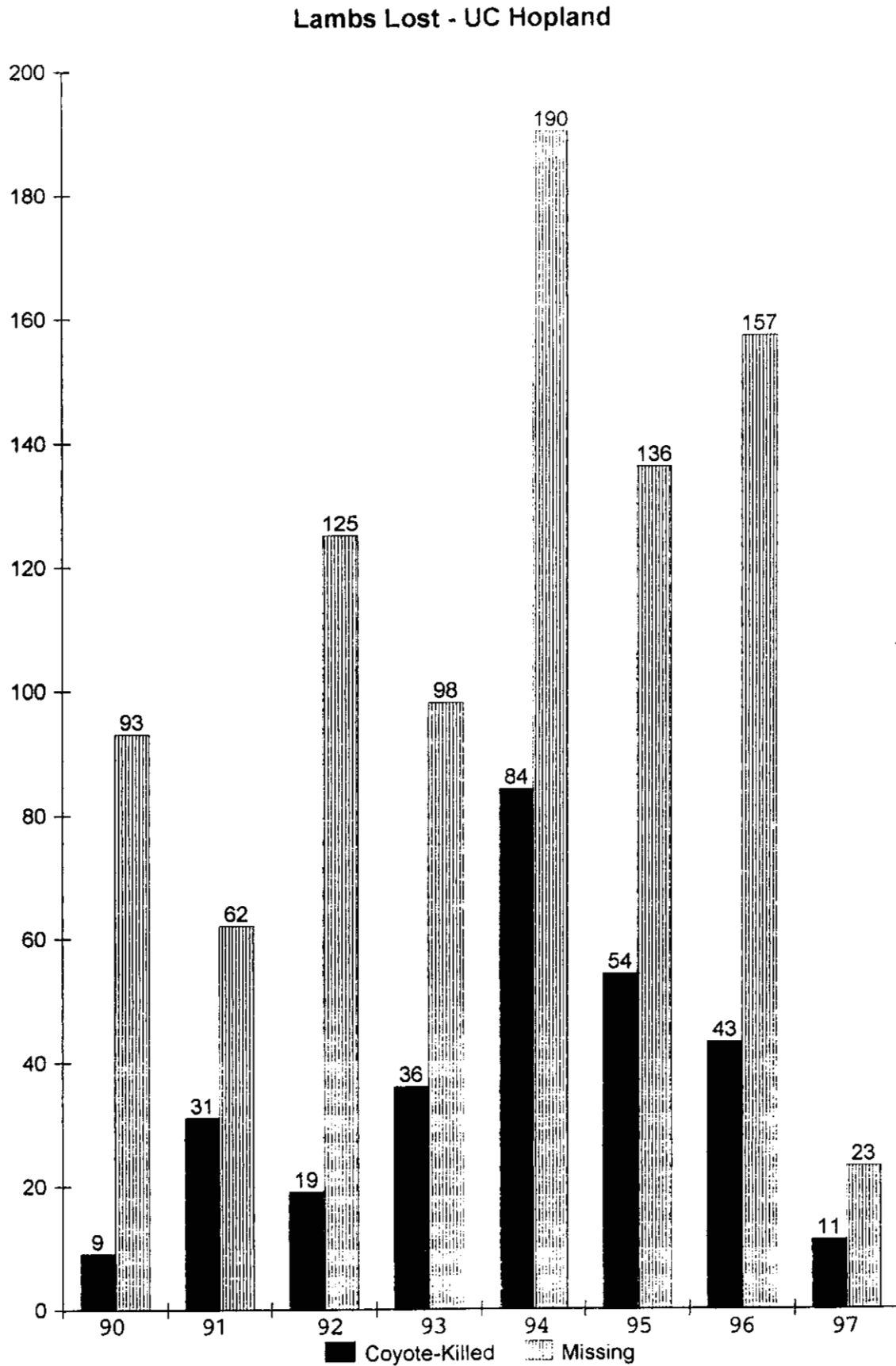
data compiled by J. Hays - HREC

Table 2.**Lambs Lost
Hopland Res. & Ext Center**

	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
# of lambs	1174	1317	1102	1312	1438	1207	1089	756
missing	93	62	125	98	190	136	157	23
lost to coyotes	9	31	19	36	84	54	43	11
total lost	102	93	144	134	274	190	200	34
% lost	8.7%	7.1%	13.1%	10.2%	19.1%	15.7%	18.4%	4.5%

revised and corrected 10/15/97

Figure 1.



(revised 10/17/97)

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March 27, 1998

Mr. Charles Hunter
Envir. Monitoring and Pest Management Branch
Dept. of Pesticide Regulation
1020 N Street, Rm. 161
Sacramento, CA 95814-5624

Dear Mr. Hunter:

Enclosed please find a single copy of our Final Progress Report for our continuing project, *Controlling Coyote Predation on Sheep in California: A Model Strategy*.

We remain encouraged that our novel approach of removing only known livestock-killing coyotes, primarily by use of the Livestock Protection Collar, is continuing to be the principal reason that we have reduced our lambs losses at Hopland to the lowest level in two decades. The anti-trap, anti-predacide initiative that may appear on the November ballot in California will pose some challenges to our work, but may also make research on alternative strategies even more timely.

I look forward to working with you in the coming months, as our research continues. Should you have any questions regarding the enclosed report, please let me know.

Sincerely,

A handwritten signature in black ink that reads 'Bob Timm'.

Robert M. Timm
Superintendent and
Extension Wildlife Specialist

Enclosure

c: Dale McCullough
Karen Blejwas
Mark Young